SUBTASK MEMORANDUM

Task: 1.3 Adequacy and validity of meteorological measurements

Subtask: 8 Assess the temporal adequacy of the measurements made in the surface
data to determine if one hour or more frequent measurements are needed

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The majority of meteorological variables are scalar, with more or less steady rates of change. In general, meteorological measurements at frequencies less than one hour therefore are not anticipated to provide much additional information. The obvious exception to this is the wind data, which is quite variable and discontinuous and thus most often expressed as a vector measurement.

To investigate the significance of differing averaging intervals, comparisons were made between 1-hour and 5-minute vector wind data from the 10-meter level of the Angiola tower. While the summation of vectors will remain the same regardless of the frequency of the data, the 5-minute vector data will almost always take a more meandering path than the 1-hour data. To investigate this, hourly wind run values were calculated for both the 5-minute and 1-hour vector data for the month of December 2000. **Table 1** summarizes the results.

On average, use of the 5-minute data results in hourly wind runs that are about 0.43 kilometers greater than those obtained using the 1-hour data. This difference is fairly consistent throughout the dataset, with little dependence on wind speeds, especially for wind speeds less than 2.5 m/s.

Figures 1 and 2 present plots of 12-hour forward trajectories of two typical periods (5‾minute data hourly wind runs averaging 0.47 and 0.58 kilometers, respectively). The second example (Figure 2) takes place on the day of the highest PM measurements during the CRPAQS winter intensive study. Of interest in Figure 1 is a 1-hour period where the one-hour averaged data shows virtually no movement, whereas the 5-minute data reveals travel of several kilometers. Figure 2 shows some meandering during the first six hours, followed by six hours where there is little difference between the 5-minute and 1-hour data.

Table 1. Vector Wind Run Comparison

Scalar WS range (m/s)	N	Average Scalar WS (m/s)	Average Vector WS (m/s)	Average hourly wind run – 5 min averages (km)	Average hourly wind run – 1 hr averages (km)	Diff. (km)
0 – 1	121	0.75	0.58	2.59	2.09	0.50
1 – 1.5	141	1.25	1.07	4.40	3.87	0.53
1.5 – 2	160	1.75	1.61	6.21	5.79	0.42
2 – 2.5	95	2.22	2.01	7.91	7.43	0.48
2.5 – 3	60	2.74	2.65	9.80	9.54	0.26
> 3	76	3.74	3.65	13.37	13.14	0.23
All	653	1.85	1.70	6.56	6.13	0.43

Forward Trajectory
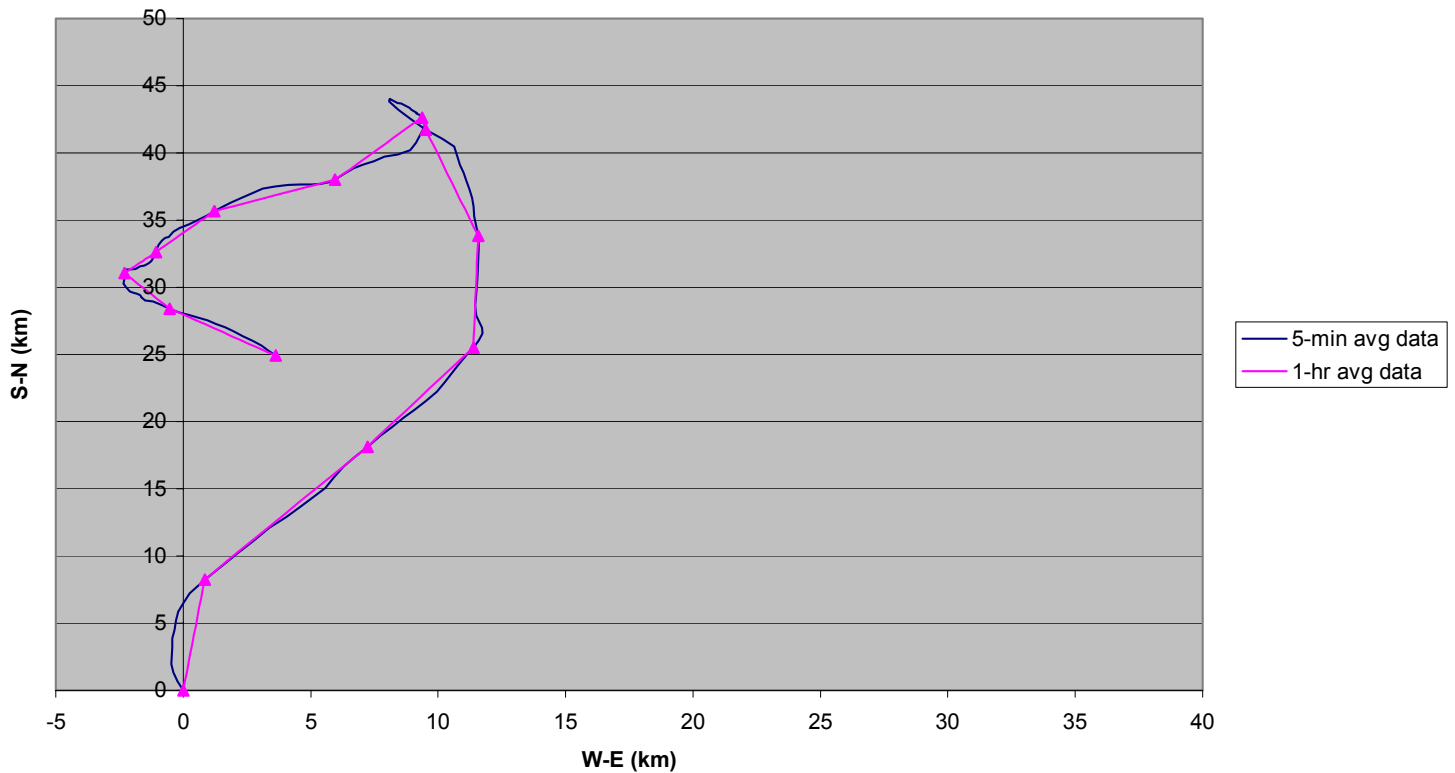**Angiola 10-m Data**
12/08/00 1:00 - 14:00

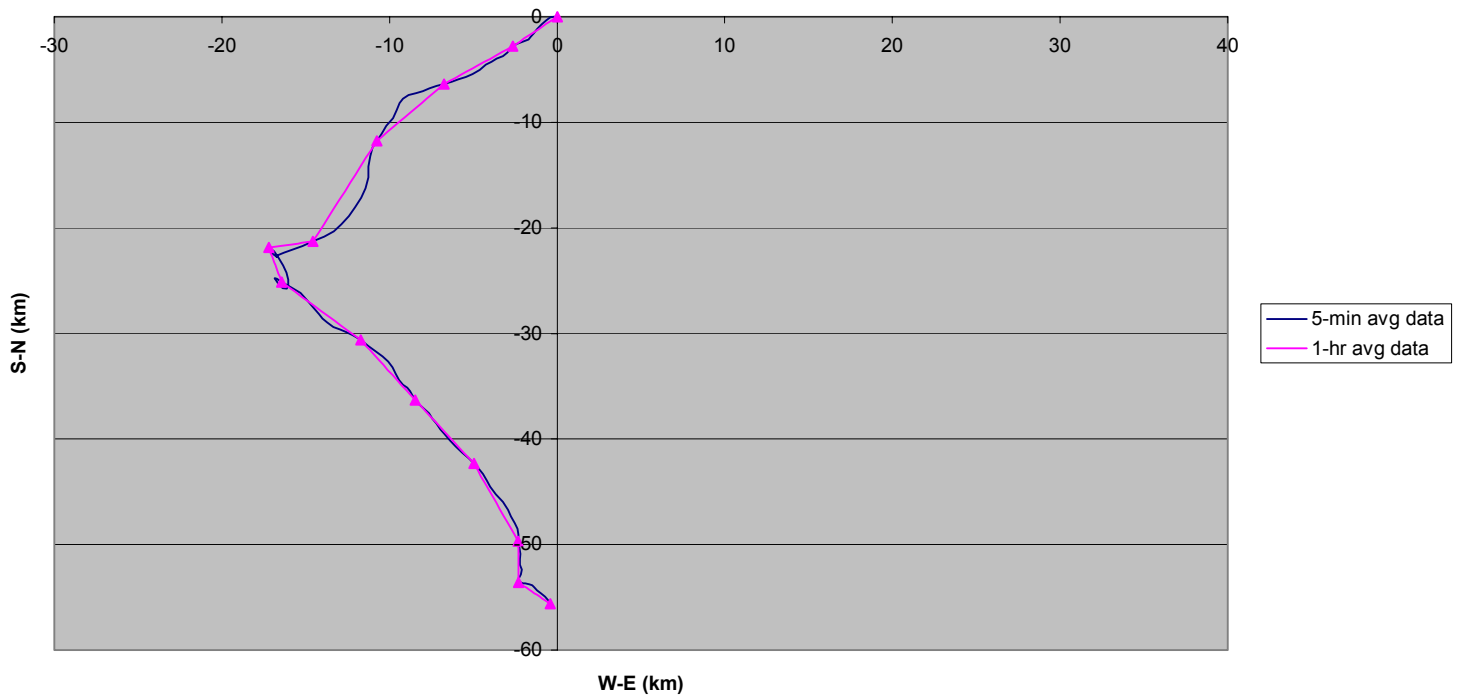Figure 1. 12-hour Forward Trajectory

Forward Trajectory
Angiola 10-m Data
12/17/00 1:00 - 14:00

Figure 2. 12-hour Forward Trajectory